NBSIR 79-1377

INTERLABORATORY PROGRAMS FOR RUBBER

ANALYSES NO. 39
JANUARY - MARCH 1979

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

- Bursting strength
- Tearing strength
- Tensile breaking strength
- Elongation to break
- Tensile energy absorption
- Folding endurance
- Stiffness
- Air resistance
- Grammage
- Smoothness
- Surface pick strength
- K & N ink absorption
- pH
- Opacity
- Blue reflectance (brightness)
- Specular gloss, 75°
- Thickness
- Concora (flat crush)
- Ring crush

FKBG-API Containerboard (48 times per year)

- Mullen burst of linerboard
- Concora test of medium

MCCA Color and Appearance (4 times per year)

- Gloss at 60°
- Color and color difference

CTS Rubber (4 times per year)

- Tensile strength, ultimate elongation and tensile stress
- Hardness
- Mooney viscosity
- Vulcanization properties

CTS Thermal Insulation Materials (2 times per year)

19 test methods for thermal insulation materials covering: thermal properties; strength properties; dimensions, stability, and density properties; fire properties; and properties of vapor barriers

ASTM Cement (2 times per year)

- Chemical (11 chemical components)
- Physical (8 characteristics)

AASHTO Bituminous

- Asphalt cement (2 times per year)
- Cutbacks (once a year)

NBS Collaborative Reference Programs
A05 Technology Building
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Washington, DC 20234

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INTERLABORATORY PROGRAMS FOR RUBBER

Analyses No. 39
January - March 1979

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U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards

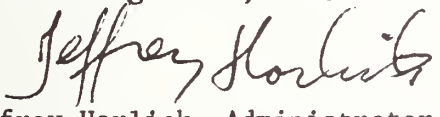
NBSIR 79-1377

INTRODUCTION

This report summarizes the test results for the first quarter of 1979. The tests cover the four areas in the NBS Collaborative Reference Programs for Rubber: Tensile Properties, Hardness, Mooney Viscosity, and Vulcanization Properties.

For each of the four areas, there is a set of summary tables followed by a table of data and analysis by laboratory and a graphical presentation of the data and analysis. Where applicable, the tables of data have the English and Metric expressions side-by-side. Additional details are given in the section "Key to Tables and Graphs."

If there are questions or comments on the notes, the analyses, or the reports in general, contact Jeffrey Horlick at (301) 921-2946.



Jeffrey Horlick, Administrator
NBS Collaborative Reference Programs
Office of Testing Laboratory Evaluation Technology

June 27, 1979

TABLE OF CONTENTS

KEY TO TABLES AND GRAPHS

LAB CODE Confidential laboratory identification number known only to the participant and the Collaborative Reference Program staff.

F A flag identifying results that are extreme in comparison with the other results.

- **X** - The plotted point for the indicated laboratory lies outside of the 99% error ellipse (not shown); ie, assuming normal distribution, 99% of laboratories similar to those participating in the program will be represented by points lying within the 99% ellipse.
- ***** - The plotted point for the indicated laboratory lies outside of the 95% error ellipse shown on graphs, but inside the 99% ellipse.

MEAN The arithmetic average of the two median values for the two sheets or samples of the same material.

% DEV The deviation or difference of the laboratory MEAN from the GR. MEAN (see below), expressed as a percent of the GR. MEAN.

REL SDR The ratio of the SDR (standard deviation of replicate measurements within a laboratory) to the AVER SDR (see below). Extreme values, ie, values that are likely to occur by chance less than one time in a hundred as determined by the chi-square test, are marked with an "X".

VAR CODE A code number designating a particular test instrument, set of environmental conditons, procedure, unit used, or other variation. The code "01" designates the instrument, conditions and procedure specified at the top of the page either explicitly or in the cited ASTM Standard, and the unit of test shown at the top of the first column of data. A '+' in front of the VAR CODE indicates that the data has been excluded from the grand means due to a non-standard variation of the possibilities mentioned above, or the data is extreme.

GR MEAN The arithmetic average (grand mean) of all the laboratory MEAN values, excluding those flagged (F) with an "X".

SD MEANS The standard deviation among the laboratory MEAN values included in the GR. MEAN.

AVER SDR The arithmetic average of all the standard deviations of within laboratory replication, excluding those excluded from the GR. MEAN and excluding any additional ones for which the REL SDR has been flagged.

GRAPH

For each laboratory the MEAN for the second material is plotted against the MEAN for the first material, with each point representing a laboratory. The horizontal and vertical lines are the GR. MEAN values. The dashed line is drawn at 45°. The solid sloping line, which may or may not lie close to the 45° line, is the major axis of the ellipse. The ellipse is drawn so that, on the average, it will include 95% of the points representing the laboratories. The plotted symbols X and * used to represent results falling outside the ellipse are explained under "F" above. Laboratories inside the ellipse (no flag in the F column) are plotted as an O.

The graph is plotted with an ellipse when there are 20 or more laboratories in the analysis. When there are 10 through 19 laboratories in the analysis, the graph is plotted but the ellipse is omitted. When there are fewer than 10 laboratories retained in the Grand Mean the graph is not plotted.

For development of the theory, see the paper by J. Mandel and T.W. Lashof, Interpretation and Generalization of Youden's Two-Sample Diagram, J. of Quality Technology, Vol. 6, pp 22-36, Jan. 1974.

SUMMARY OF ANALYSES

LABS INCL Number of laboratories included in the GR. MEANs.

LABS OMIT Number of laboratories reporting data but excluded from the GR. MEANs.

STANDARD DEVIATIONS

LABS Same as the SD MEANs (see above)

SHEETS Standard deviation between the two sheets or samples of the same material.

REPL Same as AVER SDR (see above)

PRECISION OF METHODS

REPL CRP The number of replicate measurements per sheet or sample, as specified in the Collaborative Reference Program.

REPL ASTM The number of replicate measurements specified for a test result in the designated ASTM Standard.

REPEAT The repeatability, a measure of the within laboratory precision, i.e., of the ability of the test technician to repeat his test result: two test results obtained by the same technician on the same homogeneous sample of material may be expected 95% of the time to agree within the repeatability.

REPROD The reproducibility, a measure of the between laboratory precision: two test results obtained in different laboratories may be expected 95% of the time to agree within the reproducibility.

ABSOLUTE Values of REPEAT and REPROD expressed in the units of measurement.

PERCENT Values of REPEAT and REPROD expressed as a percent of the GR. MEANs.

TENSILE STRENGTH, ULTIMATE ELONGATION, AND STRESS AT 300% ELONGATION

NOTES

Materials A91 and A92 were sheets of the same vulcanized rubber.
Similarly, materials A93 and A94 were alike.

V100 results were obtained at NBS using a pendulum tester.

All participants used Die C in ASTM D 412 with the following exceptions:

V126 used Die 2 in BS903
V208 did not specify a Die
V225 used ASTM Die D

INSTRUMENTS

Instrument	Number of Labs	Percent
Electronic Manual	20	33%
Electronic Automatic	19	32%
Pendulum Manual	18	30%
Pendulum Automatic	3	5%
	60	100%

RELATIVE HUMIDITY

Relative Humidity	Number of Labs	Percent
Below 45%	17	28%
Above 55%	12	20%
45% - 55%	22	37%
Not specified	9	15%
	60	100%

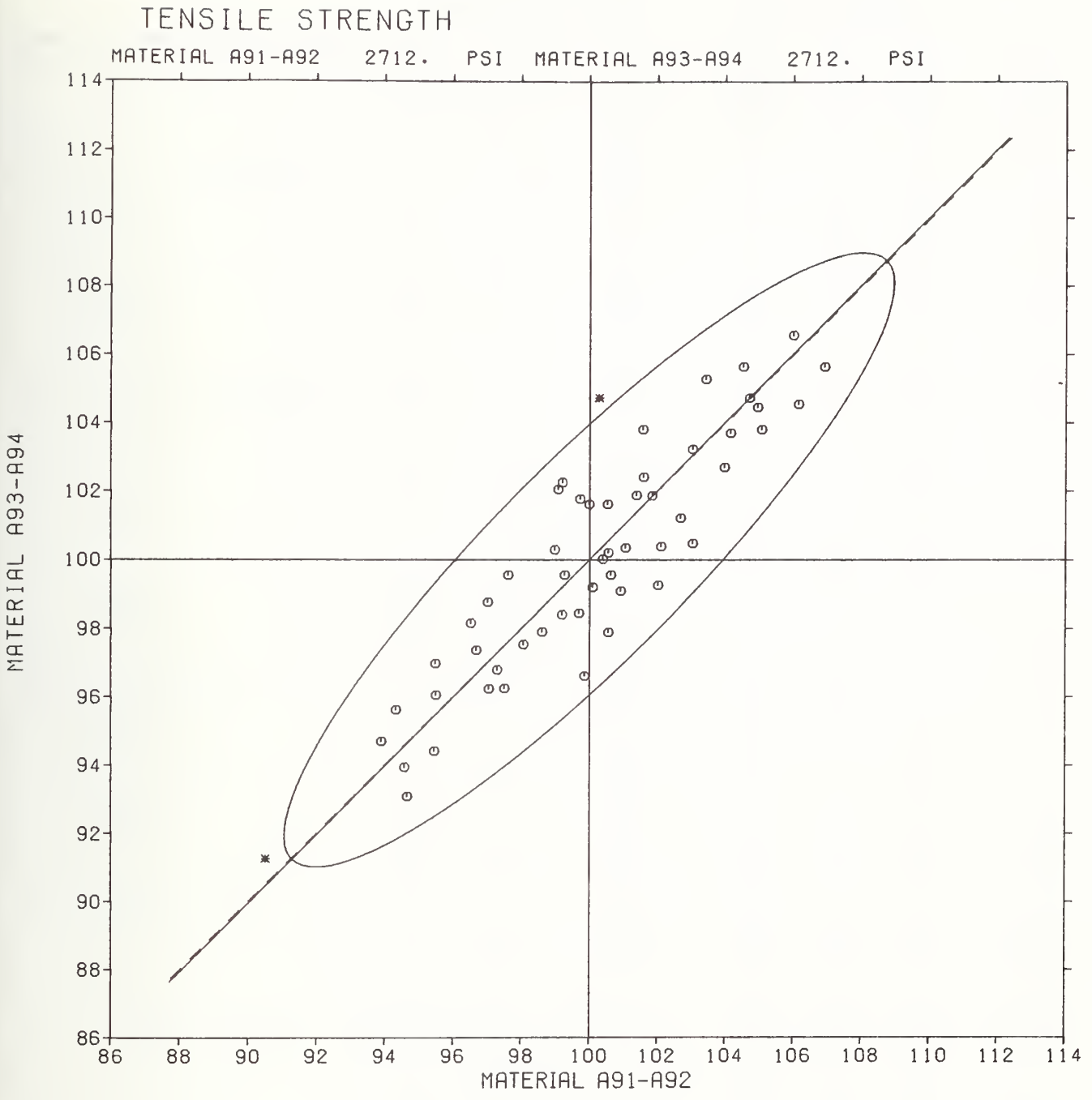
SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
TENSILE STRENGTH	A91-A92	54	6	2712.	95.	42.	60.	POUNDS PER SQUARE INCH
	A93-A94	54	6	2712.	96.	37.	58.	POUNDS PER SQUARE INCH
TENSILE STRENGTH	A91-A92	54	6	18.71	.66	.29	.42	MEGAPASCALS
	A93-A94	54	6	18.70	.66	.26	.40	MEGAPASCALS
ULTIMATE ELONGATION	A91-A92	57	3	624.	22.	7.	15.	PERCENT
	A93-A94	57	3	619.	23.	6.	14.	PERCENT
STRESS AT 300% ELONGATION	A91-A92	56	4	1163.	73.	13.	25.	POUNDS PER SQUARE INCH
	A93-A94	56	4	1162.	70.	14.	28.	POUNDS PER SQUARE INCH
STRESS AT 300% ELONGATION	A91-A92	56	4	8.018	.503	.114	.175	MEGAPASCALS
	A93-A94	56	4	8.017	.483	.122	.196	MEGAPASCALS

PRECISION OF METHODS

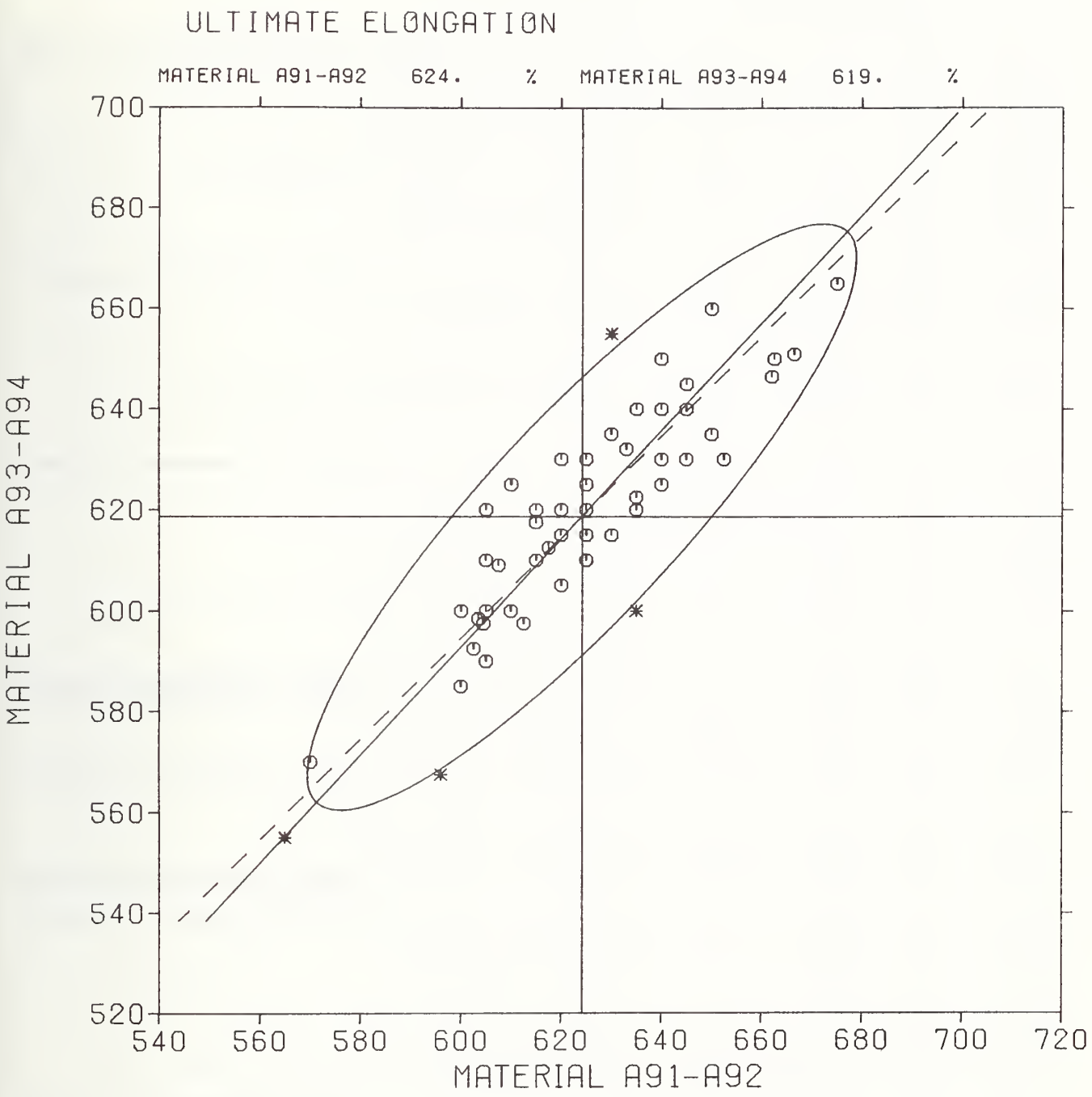
PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
TENSILE STRENGTH	A91-A92	5	5	2712.	167.	264.	PSI	6.2	9.7
	A93-A94	5	5	2712.	160.	265.	PSI	5.9	9.8
TENSILE STRENGTH	A91-A92	5	5	18.71	1.15	1.82	MEGAPA	6.2	9.7
	A93-A94	5	5	18.70	1.10	1.83	MEGAPA	5.9	9.8
ULTIMATE ELONGATION	A91-A92	5	5	624.	41.	60.	%	6.6	9.6
	A93-A94	5	5	619.	38.	64.	%	6.2	10.3
STRESS AT 300% ELONGATION	A91-A92	5	5	1163.	70.	202.	PSI	6.0	17.4
	A93-A94	5	5	1162.	79.	194.	PSI	6.8	16.7
STRESS AT 300% ELONGATION	A91-A92	5	5	8.018	.484	1.393	MEGAPA	6.0	17.4
	A93-A94	5	5	8.017	.543	1.337	MEGAPA	6.8	16.7

LAB CODE	P	MATERIAL A91-A92 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MATERIAL A93-A94 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062	*	2455.	16.93	-9.5	.66	2475.	17.07	-8.7	.48	01	
V0067		2590.	17.86	-4.5	2.47X	2630.	18.14	-3.0	.72	01	
V0069		2691.	18.56	-.8	1.38	2773.	19.12	2.3	2.12X	01	
V0070		2840.	19.59	4.7	1.06	2840.	19.59	4.7	.56	01	
V0071		2631.	18.15	-3.0	3.40X	2678.	18.47	-1.2	1.38	01	
V0072		2765.	19.07	1.9	.76	2735.	18.86	.9	1.29	*70	DATA RECEIVED LATE
V0073		2762.	19.05	1.8	1.14	2762.	19.05	1.9	1.68	01	
V0076		2820.	19.45	4.0	1.24	2785.	19.21	2.7	1.66	01	
V0078		2547.	17.57	-6.1	1.10	2568.	17.71	-5.3	1.03	01	
V0083		2632.	18.16	-2.9	.41	2610.	18.00	-3.8	.58	01	
V0084		2705.	18.66	-.3	1.97X	2760.	19.03	1.8	2.07X	01	
V0085		2741.	18.90	1.1	.96	2722.	18.77	.4	1.49	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		2715.	18.72	.1	1.23	2690.	18.55	-.8	1.06	01	
V0088	X	2246.	15.49	-17.2	1.61	2240.	15.45	-17.4	.80	01	
V0092		2685.	18.52	-1.0	1.43	2720.	18.76	.3	1.06	01	
V0095		2825.	19.48	4.2	1.21	2813.	19.40	3.7	1.17	01	
V0100	*	2720.	18.76	.3	1.39	2840.	19.59	4.7	.76	01	
V0102		2590.	17.86	-4.5	1.24	2605.	17.97	-3.9	.78	01	
V0111		2795.	19.28	3.0	1.07	2810.	19.38	3.6	.82	*70	DATA RECEIVED LATE
V0117		2675.	18.45	-1.4	.72	2655.	18.31	-2.1	1.20	01	
V0123		2785.	19.21	2.7	.83	2745.	18.93	1.2	.89	01	
V0126		2879.	19.86	6.1	1.01	2835.	19.56	4.6	1.01	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		2805.	19.34	3.4	.74	2855.	19.69	5.3	1.36	01	
V0141		2769.	19.10	2.1	1.05	2722.	18.78	.4	1.00	01	
V0144		2875.	19.83	6.0	1.00	2890.	19.93	6.6	1.10	01	
V0144B		2835.	19.55	4.5	.66	2865.	19.76	5.6	.67	01	
V0146		2708.	18.68	-.1	.46	2620.	18.07	-3.4	1.47	01	
V0149		2618.	18.06	-3.5	1.52	2662.	18.36	-1.8	.89	01	
V0150		2687.	18.53	-.9	.76	2767.	19.09	2.1	.81	01	
V0152		2900.	20.00	6.9	1.08	2865.	19.76	5.6	1.41	01	
V0153		2622.	18.09	-3.3	1.85	2640.	18.21	-2.6	.85	01	
V0154		2850.	19.66	5.1	.40	2815.	19.41	3.8	.47	01	
V0156		2755.	19.00	1.6	1.20	2815.	19.41	3.8	.88	01	
V0158		2756.	19.00	1.6	1.15	2777.	19.15	2.4	.68	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0160		2558.	17.64	-5.7	1.69	2593.	17.88	-4.4	.99	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0164		2729.	18.82	.6	.95	2700.	18.62	-.4	.80	01	
V0166		2723.	18.78	.4	1.22	2712.	18.71	.0	.92	01	
V0168		2846.	19.63	4.9	.46	2832.	19.53	4.4	1.08	01	
V0169		2712.	18.70	-.0	1.07	2756.	19.00	1.6	1.78	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		2645.	18.24	-2.5	.56	2610.	18.00	-3.8	.58	01	
V0184		2639.	18.20	-2.7	.72	2625.	18.10	-3.2	.82	01	
V0190		2750.	18.97	1.4	1.41	2763.	19.06	1.9	1.40	01	
V0199		2647.	18.26	-2.4	1.33	2700.	18.62	-.4	.73	01	
V0208		2690.	18.55	-.8	.91	2669.	18.40	-1.6	1.25	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		2704.	18.65	-.3	.75	2670.	18.41	-1.5	1.13	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0214		2727.	18.80	.5	1.20	2756.	19.00	1.6	.67	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0219	X	3149.	21.72	16.1	1.53	3036.	20.94	12.0	1.81	01	
V0223		2660.	18.34	-1.9	.77	2645.	18.24	-2.5	1.00	01	
V0224		2795.	19.28	3.0	2.95X	2725.	18.79	.5	1.42	01	
V0225		2565.	17.69	-5.4	2.01X	2547.	17.57	-6.1	1.30	01	
V0232		2692.	18.57	-.7	.85	2700.	18.62	-.4	.92	01	
V0233		2767.	19.08	2.0	.93	2692.	18.57	-.7	2.04X	01	
V0235		2727.	18.81	.6	1.03	2654.	18.31	-2.1	1.29	01	
V0238	X	3110.	21.45	14.7	2.27X	3007.	20.74	10.9	1.61	01	
V0243		2727.	18.81	.6	.75	2717.	18.74	.2	.67	01	
V0244		2795.	19.28	3.0	.64	2799.	19.31	3.2	.62	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0245A		2567.	17.71	-5.3	1.04	2524.	17.41	-6.9	.44	01	
V0245B		2589.	17.86	-4.5	.64	2560.	17.66	-5.6	1.57	01	
V0249		2635.	18.17	-2.9	.99	2640.	18.21	-2.7	1.14	*70	DATA RECEIVED LATE
V0250		2737.	18.88	.9	1.18	2687.	18.53	-.9	.52	01	
		2712.	18.71	* GR. MEAN *		2712.	18.70				5 TEST DETERMINATIONS
		95.	.66	* SD MEANS *		96.	.66				54 LABORATORIES IN GRAND MEANS
		60.	.42	* AVER SDR *		58.	.40				60 LABORATORIES REPORTING
		PSI	MEGAPA	* UNIT *		PSI	MEGAPA				

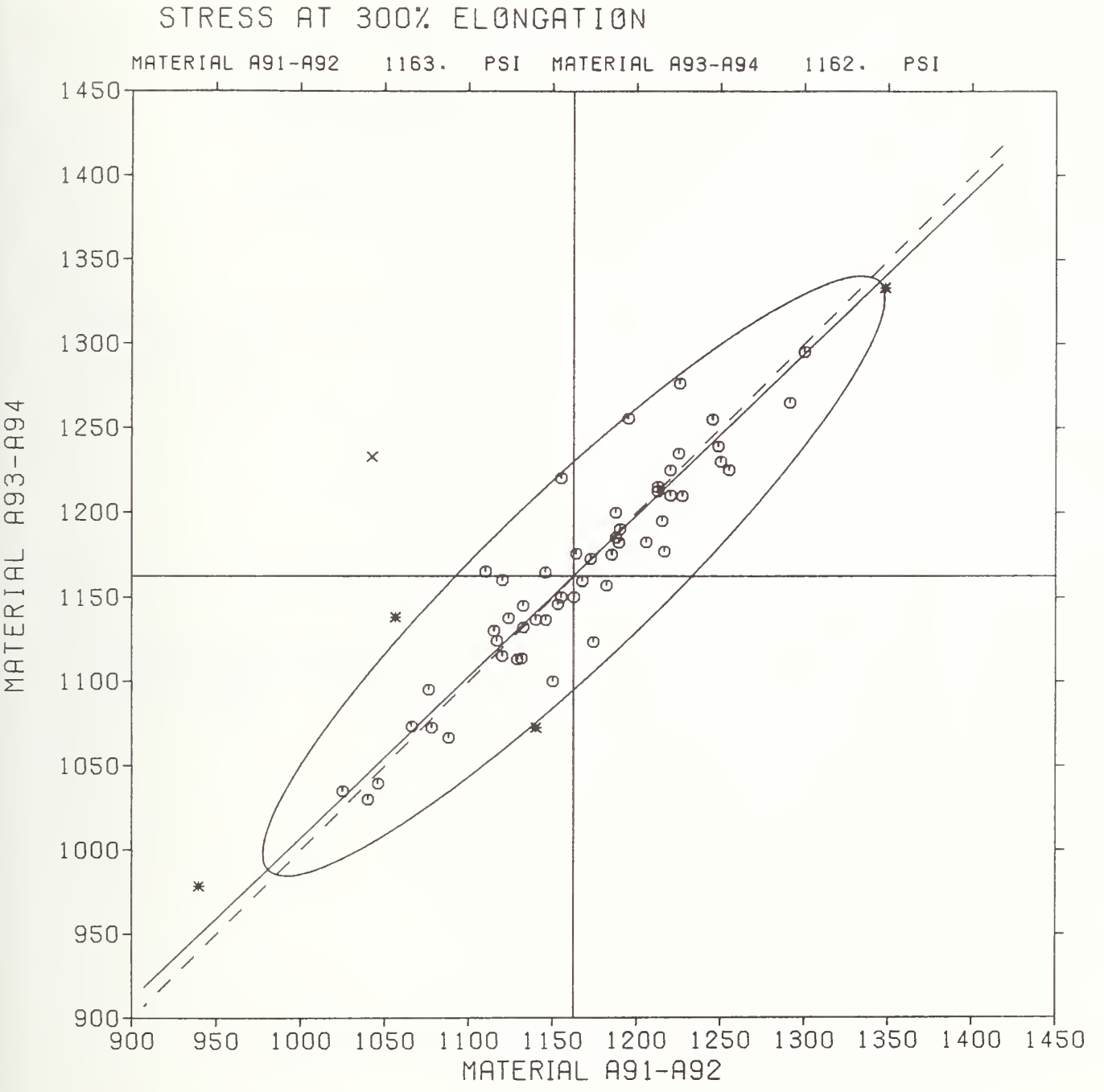

TENSILE STRENGTH
MATERIAL A91-A92 2712. PSI MATERIAL A93-A94 2712. PSI
MATERIAL A93-A94
MATERIAL A91-A92
114
112
110
108
106
104
102
100
98
96
94
92
90
88
86
86 88 90 92 94 96 98 100 102 104 106 108 110 112 114

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER
ULTIMATE ELONGATION - PERCENT

LAB CODE	F	MATERIAL A91-A92 COMMERCIAL TIRE TREAD MEAN %	% DEV	REL SDR	MATERIAL A93-A94 COMMERCIAL TIRE TREAD MEAN %	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062		603.	-3.3	.47	598.	-3.3	.59	01	
V0067		605.	-3.1	2.34X	610.	-1.4	.64	01	
V0069	*	630.	.9	1.40	655.	5.9	2.47X	01	
V0070		615.	-1.5	.57	617.	-.2	.64	01	
V0071		604.	-3.1	3.13X	597.	-3.4	1.46	01	
V0072		605.	-3.1	.93	595.	-3.8	.95	.70	DATA RECEIVED LATE
V0073		645.	3.3	1.22	640.	3.4	1.59	01	
V0076		605.	-3.1	1.14	590.	-4.6	1.51	01	
V0078		620.	-.7	1.17	615.	-.6	1.14	01	
V0083		635.	1.7	.75	622.	.6	.54	01	
V0084		600.	-3.9	1.38	600.	-3.0	1.16	01	
V0085		662.	6.1	.57	650.	5.1	1.40	01	
V0087		607.	-2.7	1.51	609.	-1.6	.99	01	
V0088	*	596.	-4.5	2.73X	567.	-8.3	1.02	01	
V0092		630.	.9	1.09	635.	2.6	.89	01	
V0095		630.	.9	1.36	615.	-.6	1.32	01	
V0100		640.	2.5	1.32	640.	3.4	.92	01	
V0102		625.	.1	.79	625.	1.0	.61	01	
V0111		632.	1.3	1.08	631.	2.1	.73	.70	DATA RECEIVED LATE
V0117		625.	.1	1.05	620.	.2	1.66	01	
V0123		640.	2.5	.75	625.	1.0	.84	01	
V0126		662.	6.1	1.16	646.	4.5	1.17	01	
V0128		625.	.1	.88	630.	1.8	.71	01	
V0141		625.	.1	.62	610.	-1.4	.42	01	
V0144		650.	4.1	.66	635.	2.6	1.05	01	
V0144B		640.	2.5	.81	630.	1.8	.73	01	
V0146		612.	-1.9	1.01	597.	-3.4	1.34	01	
V0149		617.	-1.1	1.38	612.	-1.0	.67	01	
V0150		620.	-.7	.48	630.	1.8	.60	01	
V0152		615.	-1.5	1.10	610.	-1.4	1.30	01	
V0153		610.	-2.3	.95	625.	1.0	.47	01	
V0154		605.	-3.1	.46	590.	-4.6	.67	01	
V0156		605.	-3.1	1.24	600.	-3.0	1.55	01	
V0158		675.	8.2	1.38	665.	7.5	.58	01	
V0160		605.	-3.1	1.24	620.	.2	.91	01	
V0164		602.	-3.5	.97	592.	-4.2	.20	01	
V0166		605.	-3.1	.83	610.	-1.4	.56	01	
V0168		645.	3.3	.55	630.	1.8	.87	01	
V0169		635.	1.7	1.28	640.	3.4	1.49	01	
V0176		625.	.1	.83	615.	-.6	.84	01	
V0184		620.	-.7	.66	620.	.2	.88	01	
V0190		640.	2.5	1.00	640.	3.4	1.49	01	
V0199		625.	.1	1.32	610.	-1.4	1.08	01	
V0208		600.	-3.9	.84	585.	-5.4	.77	01	
V0213		633.	1.4	.90	632.	2.2	1.17	01	
V0214		640.	2.5	1.64	650.	5.1	.70	01	
V0219		615.	-1.5	1.49	610.	-1.4	1.00	01	
V0223		615.	-1.5	1.12	620.	.2	1.10	01	
V0224		652.	4.5	1.72	630.	1.8	1.27	01	
V0225	*	565.	-9.5	1.32	555.	-10.3	1.22	01	
V0232		650.	4.1	.99	660.	6.7	1.16	01	
V0233		620.	-.7	.94	605.	-2.2	2.24X	01	
V0235		666.	6.8	.95	651.	5.2	1.57	01	
V0238	*	635.	1.7	1.37	600.	-3.0	1.09	01	
V0243		645.	3.3	.45	645.	4.3	.67	01	
V0244		640.	2.5	.39	640.	3.4	.00	01	
V0245A		570.	-8.7	.68	570.	-7.9	.87	01	
V0245B		610.	-2.3	.93	600.	-3.0	1.74	01	
V0249		650.	4.1	.88	655.	5.9	.50	.70	DATA RECEIVED LATE
V0250		635.	1.7	.91	620.	.2	.39	01	
		624.	* GR. MEAN *		619.			5	TEST DETERMINATIONS
		22.	* SD MEANS *		23.			57	LABORATORIES IN GRAND MEANS
		15.	* AVER SDR *		14.			60	LABORATORIES REPORTING
		%	* UNIT *		%				


ULTIMATE ELØNGATIØN
MATERIAL A91-A92 624. %
MATERIAL A93-A94 619. %
MATERIAL A93-A94
MATERIAL A91-A92
700
680
660
640
620
600
580
560
540
520
540
560
580
600
620
640
660
680
700
720

LAB CODE	F	MATERIAL A91-A92 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MATERIAL A93-A94 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062		1120.	7.724	-3.7	1.03	1115.	7.690	-4.1	.74	01	
V0067		1187.	8.190	2.1	.52	1185.	8.172	1.9	.58	01	
V0069		1129.	7.786	-2.9	2.16X	1113.	7.676	-4.2	.84	01	
V0070		1190.	8.207	2.4	.69	1190.	8.207	2.4	1.03	01	
V0071		1195.	8.241	2.8	1.78	1255.	8.659	8.0	1.42	01	
V0072		1140.	7.862	-1.9	1.08	1150.	7.931	-1.1	1.09	*70	DATA RECEIVED LATE
V0073		1162.	8.017	-.0	2.65X	1150.	7.931	-1.1	1.83	01	
V0076		1300.	8.966	11.8	1.11	1295.	8.931	11.4	.80	01	
V0078		1078.	7.434	-7.3	1.09	1072.	7.397	-7.7	.83	01	
V0083		1132.	7.810	-2.6	.71	1145.	7.897	-1.5	.60	01	
V0084		1185.	8.172	1.9	1.52	1175.	8.103	1.1	.79	01	
V0085		1076.	7.422	-7.4	1.05	1095.	7.552	-5.8	.62	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		1255.	8.655	7.9	1.11	1225.	8.448	5.4	.75	01	
V0088	*	939.	6.479	-19.2	2.01X	978.	6.748	-15.8	1.32	01	
V0092		1025.	7.069	-11.8	.63	1035.	7.138	-11.0	.92	01	
V0095		1212.	8.362	4.3	1.24	1212.	8.362	4.3	1.02	01	
V0100		1120.	7.724	-3.7	1.27	1160.	8.000	-.2	.84	01	
V0102		1040.	7.172	-10.5	.74	1030.	7.103	-11.4	.71	01	
V0111		1165.	8.034	.2	.84	1170.	8.069	.7	.51	*70	DATA RECEIVED LATE
V0117		1155.	7.966	-.7	.83	1150.	7.931	-1.1	.60	01	
V0123		1215.	8.379	4.5	.66	1195.	8.241	2.8	.58	01	
V0126		1146.	7.902	-1.4	.41	1136.	7.837	-2.2	1.10	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		1220.	8.414	4.9	1.17	1225.	8.448	5.4	.67	01	
V0141		1248.	8.610	7.4	.88	1239.	8.545	6.6	.43	01	
V0144		1110.	7.655	-4.5	1.03	1165.	8.034	.2	1.26	01	
V0144B		1155.	7.966	-.7	.92	1220.	8.414	5.0	1.84	01	
V0146		1216.	8.390	4.6	1.47	1177.	8.117	1.3	1.06	01	
V0149	*	1056.	7.286	-9.1	1.21	1138.	7.848	-2.1	.94	01	
V0150		1187.	8.190	2.1	.96	1200.	8.276	3.2	1.07	01	
V0152		1225.	8.448	5.4	.41	1235.	8.517	6.2	.53	01	
V0153		1145.	7.900	-1.5	1.17	1164.	8.031	.2	1.31	01	
V0154		1250.	8.621	7.5	.71	1230.	8.483	5.8	.58	01	
V0156		1245.	8.586	7.1	1.45	1255.	8.655	8.0	1.21	01	
V0158		1066.	7.352	-8.3	.97	1073.	7.402	-7.7	.72	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0160		1189.	8.202	2.3	1.18	1182.	8.152	1.7	.95	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0164		1132.	7.810	-2.6	2.36X	1132.	7.807	-2.6	1.39	01	
V0166		1131.	7.803	-2.7	1.03	1113.	7.679	-4.2	1.25	01	
V0168		1164.	8.028	.1	.62	1175.	8.107	1.1	.46	01	
V0169		1153.	7.952	-.8	1.56	1146.	7.902	-1.4	1.12	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		1220.	8.414	4.9	1.07	1210.	8.345	4.1	1.37	01	
V0184		1140.	7.862	-1.9	.96	1136.	7.838	-2.2	1.09	01	
V0190		1182.	8.152	1.7	1.71	1157.	7.979	-.5	.89	01	
V0199		1172.	8.086	.9	.96	1172.	8.086	.9	.94	01	
V0208		1226.	8.452	5.4	2.17X	1276.	8.802	9.8	1.52	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		1174.	8.097	1.0	1.39	1123.	7.747	-3.4	.80	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0214		1117.	7.702	-3.9	.38	1124.	7.752	-3.3	.41	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0219	*	1348.	9.297	15.9	1.66	1333.	9.193	14.7	1.53	01	
V0223		1115.	7.690	-4.1	1.14	1130.	7.793	-2.8	1.40	01	
V0224		1212.	8.362	4.3	1.44	1215.	8.379	4.5	1.73	01	
V0225		1291.	8.903	11.0	.98	1265.	8.724	8.8	1.34	01	
V0232	*	1140.	7.862	-1.9	.26	1072.	7.397	-7.7	.16	01	
V0233		1205.	8.314	3.7	.96	1182.	8.155	1.7	1.02	01	
V0235		1088.	7.503	-6.4	.75	1066.	7.355	-8.3	.77	01	
V0238	X	1042.	7.190	-10.3	.88	1232.	8.500	6.0	1.30	01	
V0243		1046.	7.214	-10.0	.69	1039.	7.169	-10.6	1.04	01	
V0244		1227.	8.462	5.5	.75	1210.	8.342	4.1	1.11	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0245A		1167.	8.052	.4	2.05X	1159.	7.997	-.2	1.31	01	
V0245B		1123.	7.748	-3.4	1.01	1137.	7.845	-2.1	.96	01	
V0249		1040.	7.172	-10.5	.65	1010.	6.966	-13.1	.72	*70	DATA RECEIVED LATE
V0250		1150.	7.931	-1.1	.76	1100.	7.586	-5.4	1.06	01	
		1163.	8.018	* GR. MEAN *		1162.	8.017				5 TEST DETERMINATIONS
		73.	.503	* SD MEANS *		70.	.483				56 LABORATORIES IN GRAND MEANS
		25.	.175	* AVER SDR *		28.	.196				60 LABORATORIES REPORTING
		PSI	MEGAPA	* UNIT *		PSI	MEGAPA				


STRESS AT 300% ELONGATION
MATERIAL A91-A92 1163. PSI MATERIAL A93-A94 1162. PSI
MATERIAL A93-A94
MATERIAL A91-A92
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
900 950 1000 1050 1100 1150 1200 1250 1300 1350 1400 1450

HARDNESS

NOTES

Materials A91 and A92 were sheets of the same vulcanized rubber. Similarly, materials A93 and A94 were alike.

V100 results were obtained at NBS using ASTM D2240. V200 results were obtained at NBS using ASTM D1415.

Four of the 31 participants reporting used ASTM D1415 (Wallace) for the hardness determination. All others used ASTM D2240 (Type A Durometer).

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
HARDNESS	A91-A92	29	2	58.16	1.42	.20	.54	IRHD
	A93-A94	29	2	58.16	1.74	.28	.47	IRHD

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 39 - 2 FEBRUARY 1979

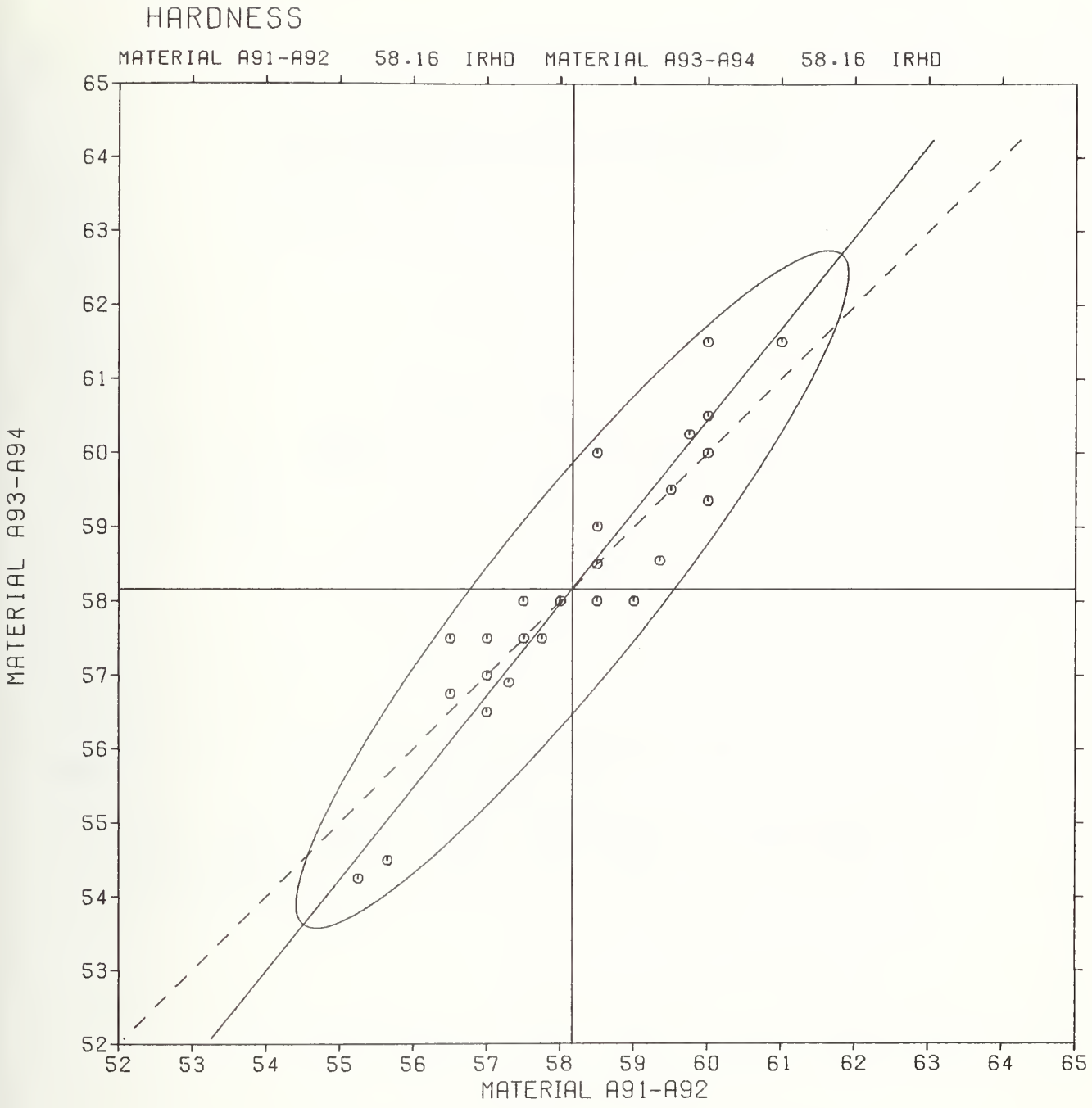
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CBP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
HARDNESS	A91-A92	5	5	58.16	1.50	3.94	IRHD	2.6	6.8
	A93-A94	5	5	58.16	1.32	4.81	IRHD	2.3	8.3

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 39 - 2 HARDNESS - IRHD FEBRUARY 1979

LAB CODE	F	MATERIAL A91-A92 COMMERCIAL TIRE TREAD MEAN IRHD	% DEV	REL SDR	MATERIAL A93-A94 COMMERCIAL TIRE TREAD MEAN IRHD	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062		60.00	3.2	.00	61.50	5.7	.58	01	
V0069		58.00	-.3	1.43	58.00	-.3	1.15	01	
V0070		56.50	-2.8	3.72X	57.50	-1.1	2.35X	01	
V0071		57.00	-2.0	1.07	57.50	-1.1	1.46	01	
V0072		56.50	-2.8	1.28	57.00	-2.0	.00	*70	DATA RECEIVED LATE
V0078		57.50	-1.1	1.28	58.00	-.3	1.41	01	
V0084		59.00	1.4	.41	58.00	-.3	1.05	01	
V0085		59.35	2.1	1.19	58.55	.7	.72	01	
V0087		61.00	4.9	.00	61.50	5.7	.00	01	
V0088		58.00	-.3	1.28	58.00	-.3	1.46	01	
V0092		58.50	.6	1.24	60.00	3.2	2.23X	01	
V0095		57.50	-1.1	.51	57.50	-1.1	.47	01	
V0100		55.25	-5.0	.58	54.25	-6.7	.61	01	
V0102		59.50	2.3	1.33	59.50	2.3	2.03X	01	
V0111		59.00	1.4	.92	59.00	1.4	.58	*70	DATA RECEIVED LATE
V0128		57.00	-2.0	1.01	56.50	-2.8	.58	01	
V0141		57.00	-2.0	.83	56.50	-2.8	1.05	01	
V0144		58.50	.6	1.34	58.00	-.3	1.20	01	
V0144B		58.50	.6	1.62	58.50	.6	1.05	01	
V0168		59.75	2.7	.41	60.25	3.6	.61	01	
V0169		57.00	-2.0	.41	57.00	-2.0	1.05	01	
V0176		57.75	-.7	1.26	57.50	-1.1	.81	01	
V0190		60.00	3.2	.41	60.50	4.0	1.15	01	
V0200		55.65	-4.3	.62	54.50	-6.3	.50	01	
V0208		57.30	-1.5	1.28	56.90	-2.2	1.73	01	
V0214		60.00	3.2	1.73	59.35	2.1	2.51X	01	
V0224		60.00	3.2	1.07	60.00	3.2	1.69	01	
V0233		58.50	.6	1.33	59.00	1.4	1.35	01	
V0235		56.50	-2.8	.33	56.75	-2.4	.91	01	
V0243		57.50	-1.1	.00	57.50	-1.1	.47	01	
V0244		58.50	.6	1.01	58.00	-.3	.94	01	
		58.16	* GR. MEAN *		58.16				5 TEST DETERMINATIONS
		1.42	* SD MEANS *		1.74				29 LABORATORIES IN GRAND MEANS
		.54	* AVER SDR *		.47				31 LABORATORIES REPORTING
		IRHD	* UNIT *		IRHD				


HARDNESS
MATERIAL A91-A92 58.16 IRHD
MATERIAL A93-A94 58.16 IRHD
MATERIAL A93-A94
MATERIAL A91-A92
65
64
63
62
61
60
59
58
57
56
55
54
53
52
52 53 54 55 56 57 58 59 60 61 62 63 64 65

MOONEY VISCOSITY

NOTES

Materials R91 and R92 were the same rubber. Similarly, materials R93 and R94 were the same rubber. No sample preparation was required for materials R91 and R92 whereas, mill massing was required for materials R93 and R94.

V100 results were obtained at NBS on the manually closed viscometer used for determining the Mooney viscosities of the standard rubbers.

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
MOONEY VISCOSITY	R91-R92	40	2	67.58	2.54	.15	.30	ML
	R93-R94	40	2	63.97	3.89	.53	.48	ML

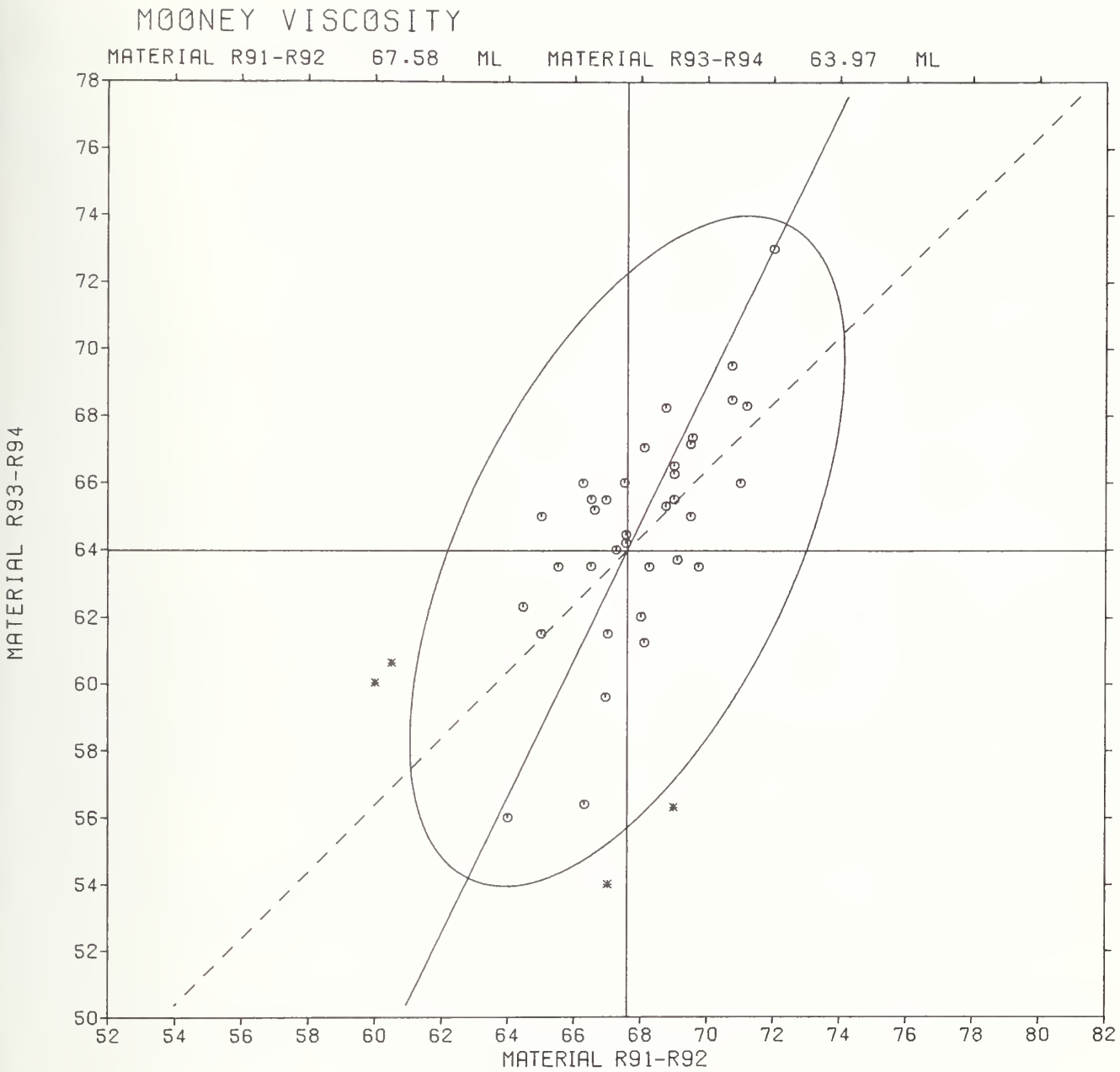
INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 39 - 4 MARCH 1979

PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
MOONEY VISCOSITY	R91-R92	3	3	67.58	.83	7.02	ML	1.2	10.4
	R93-R94	3	3	63.97	1.34	10.77	ML	2.1	16.8

LAB CODE	F	MATERIAL R91-R92 BUTYL RUBBER MEAN ML	% DEV	REL SDR	MATERIAL R93-R94 SBR MEAN ML	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		66.60	-1.5	1.52	65.20	1.9	1.55	01	
V0068		72.00	6.5	5.92X	73.00	14.1	2.78X	01	
V0071		66.95	-.9	.62	65.50	2.4	.63	01	
V0072	*	67.00	-.9	4.24X	54.00	-15.6	1.63	01	
V0077		66.30	-1.9	.48	56.40	-11.8	5.10X	01	
V0078	*	60.00	-11.2	2.62X	60.05	-6.1	.60	01	
V0083		69.50	2.8	.98	67.15	5.0	2.47X	01	
V0085	*	73.75	9.1	.97	66.50	4.0	1.31	*70	DATA RECEIVED LATE
V0090		69.75	3.2	.97	63.50	-.7	.90	01	
V0092		67.00	-.9	1.94	61.50	-3.9	1.20	01	
V0095		68.25	1.0	.97	63.50	-.7	.90	01	
V0100		69.10	2.2	.54	63.70	-.4	.34	01	
V0111	*	60.50	-10.5	1.74	60.65	-5.2	.85	01	
V0117		67.25	-.5	1.81	64.00	.0	2.18	01	
V0128		70.75	4.7	1.32	68.50	7.1	.60	01	
V0144		69.50	2.8	.00	65.00	1.6	1.04	01	
V0146		69.00	2.1	.48	66.25	3.6	.52	01	
V0149		68.10	.8	.62	67.05	4.8	1.96	01	
V0150		68.00	.6	.97	62.00	-3.1	5.77X	01	
V0156		65.50	-3.1	.97	63.50	-.7	1.20	01	
V0166		68.75	1.7	1.68	68.25	6.7	.90	01	
V0169		70.75	4.7	.48	69.50	8.6	.82	01	
V0177		64.45	-4.6	.54	62.30	-2.6	1.07	01	
V0182		69.00	2.1	.48	65.50	2.4	.00	01	
V0190		68.10	.8	.76	61.25	-4.3	.83	01	
V0207		71.20	5.3	.19	68.30	6.8	1.08	01	
V0208		67.50	-.1	.97	66.00	3.2	1.20	01	
V0211		69.00	2.1	.00	66.50	4.0	.60	01	
V0213		66.25	-2.0	1.45	66.00	3.2	.60	01	
V0214		65.00	-3.8	1.32	65.00	1.6	.90	01	
V0217		66.50	-1.6	.97	63.50	-.7	.30	01	
V0218		69.55	2.9	1.01	67.35	5.3	.56	01	
V0220		66.95	-.9	1.51	59.60	-6.8	.45	01	
V0221		67.55	-.1	.36	64.20	.4	.83	01	
V0223		66.50	-1.6	.84	65.50	2.4	1.63	01	
V0230	*	69.00	2.1	.86	56.30	-12.0	.73	01	
V0236		71.00	5.1	.57	66.00	3.2	2.39	01	
V0238		64.00	-5.3	.00	56.00	-12.5	.60	01	
V0244		65.00	-3.8	2.91X	61.50	-3.9	1.20	01	
V0249		64.00	-5.3	1.77	67.50	5.5	1.04	*70	DATA RECEIVED LATE
V0250		68.75	1.7	.76	65.30	2.1	.73	01	
V0251		67.55	-.1	1.91	64.45	.8	1.53	01	
		67.58	* GR. MEAN *		63.97				3 TEST DETERMINATIONS
		2.54	* SD MEANS *		3.89				40 LABORATORIES IN GRAND MEANS
		.30	* AVER SDR *		.48				42 LABORATORIES REPORTING
		ML	* UNIT *		ML				


MOONEY VISCOSITY
MATERIAL R91-R92 67.58 ML
MATERIAL R93-R94 63.97 ML
MATERIAL R93-R94
MATERIAL R91-R92
78
76
74
72
70
68
66
64
62
60
58
56
54
52
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82

VULCANIZATION CHARACTERISTICS USING OSCILLATING DISK CURE METER

NOTES

Materials W91 and W92 were the same rubber formulation. Similarly, materials W93 and W94 were alike.

V100 results were obtained at NBS using a Model TM-100 Monsanto Rheometer with a disk oscillating at ±1° amplitude and 1.7 hertz frequency.

All participants used Monsanto Rheometers operated at one degree amplitude and 1.7 hertz frequency.

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
SCORCH TIME	W91-W92	35	6	4.633	.267	.023	.077	MINUTES
	W93-W94	35	6	4.642	.286	.021	.050	MINUTES
CURE TIME (50% MH)	W91-W92	35	6	6.73	.32	.03	.07	MINUTES
	W93-W94	35	6	6.68	.31	.02	.06	MINUTES
CURE TIME (90% MH)	W91-W92	35	6	10.32	.53	.06	.11	MINUTES
	W93-W94	35	6	10.26	.55	.03	.09	MINUTES
MINIMUM TORQUE	W91-W92	37	4	5.07	.46	.04	.08	POUND-INCHES
	W93-W94	37	4	5.01	.42	.03	.07	POUND-INCHES
MINIMUM TORQUE	W91-W92	34	7	.5726	.0521	.0058	.0086	NEWTON-METERS
	W93-W94	34	7	.5664	.0472	.0039	.0077	NEWTON-METERS
MAXIMUM TORQUE	W91-W92	38	3	23.52	1.57	.06	.13	POUND-INCHES
	W93-W94	38	3	23.46	1.51	.04	.08	POUND-INCHES
MAXIMUM TORQUE	W91-W92	38	3	2.6577	.1773	.0087	.0142	NEWTON-METERS
	W93-W94	38	3	2.6503	.1710	.0054	.0092	NEWTON-METERS

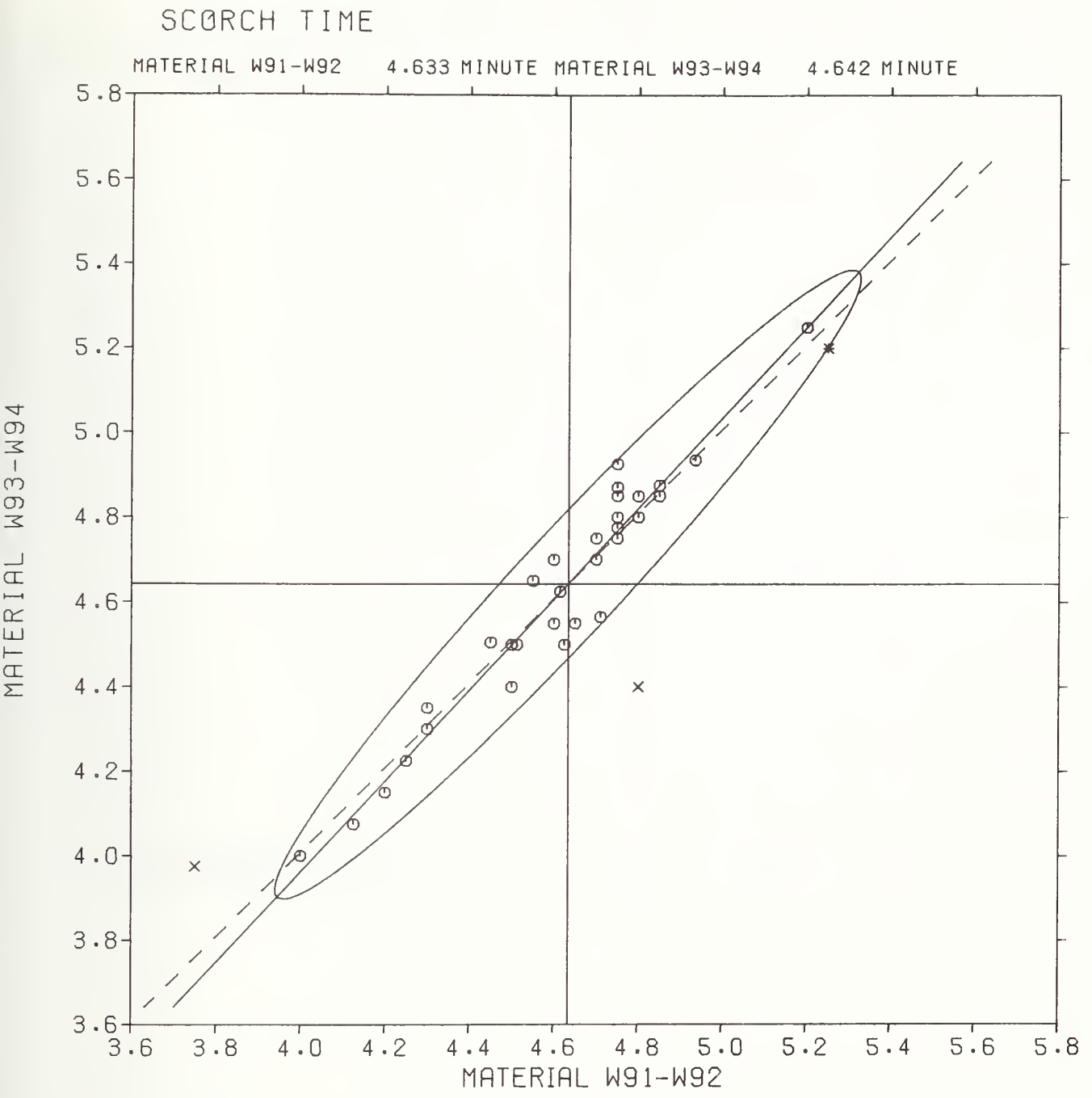
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
SCORCH TIME	W91-W92	3	3	4.633	.213	.739	MINUTE	4.6	16.0
	W93-W94	3	3	4.642	.139	.792	MINUTE	3.0	17.1
CURE TIME (50% MH)	W91-W92	3	3	6.73	.20	.89	MINUTE	3.0	13.2
	W93-W94	3	3	6.68	.17	.85	MINUTE	2.6	12.8
CURE TIME (90% MH)	W91-W92	3	3	10.32	.30	1.48	MINUTE	2.9	14.3
	W93-W94	3	3	10.26	.24	1.53	MINUTE	2.3	14.9
MINIMUM TORQUE	W91-W92	3	3	5.07	.21	1.28	LB-IN.	4.2	25.2
	W93-W94	3	3	5.01	.19	1.16	LB-IN.	3.8	23.1
MINIMUM TORQUE	W91-W92	3	3	.5726	.0238	.1443	N-M	4.2	25.2
	W93-W94	3	3	.5664	.0213	.1308	N-M	3.8	23.1
MAXIMUM TORQUE	W91-W92	3	3	23.52	.35	4.35	LB-IN.	1.5	18.5
	W93-W94	3	3	23.46	.23	4.19	LB-IN.	1.0	17.9
MAXIMUM TORQUE	W91-W92	3	3	2.6577	.0393	.4911	N-M	1.5	18.5
	W93-W94	3	3	2.6503	.0254	.4736	N-M	1.0	17.9

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

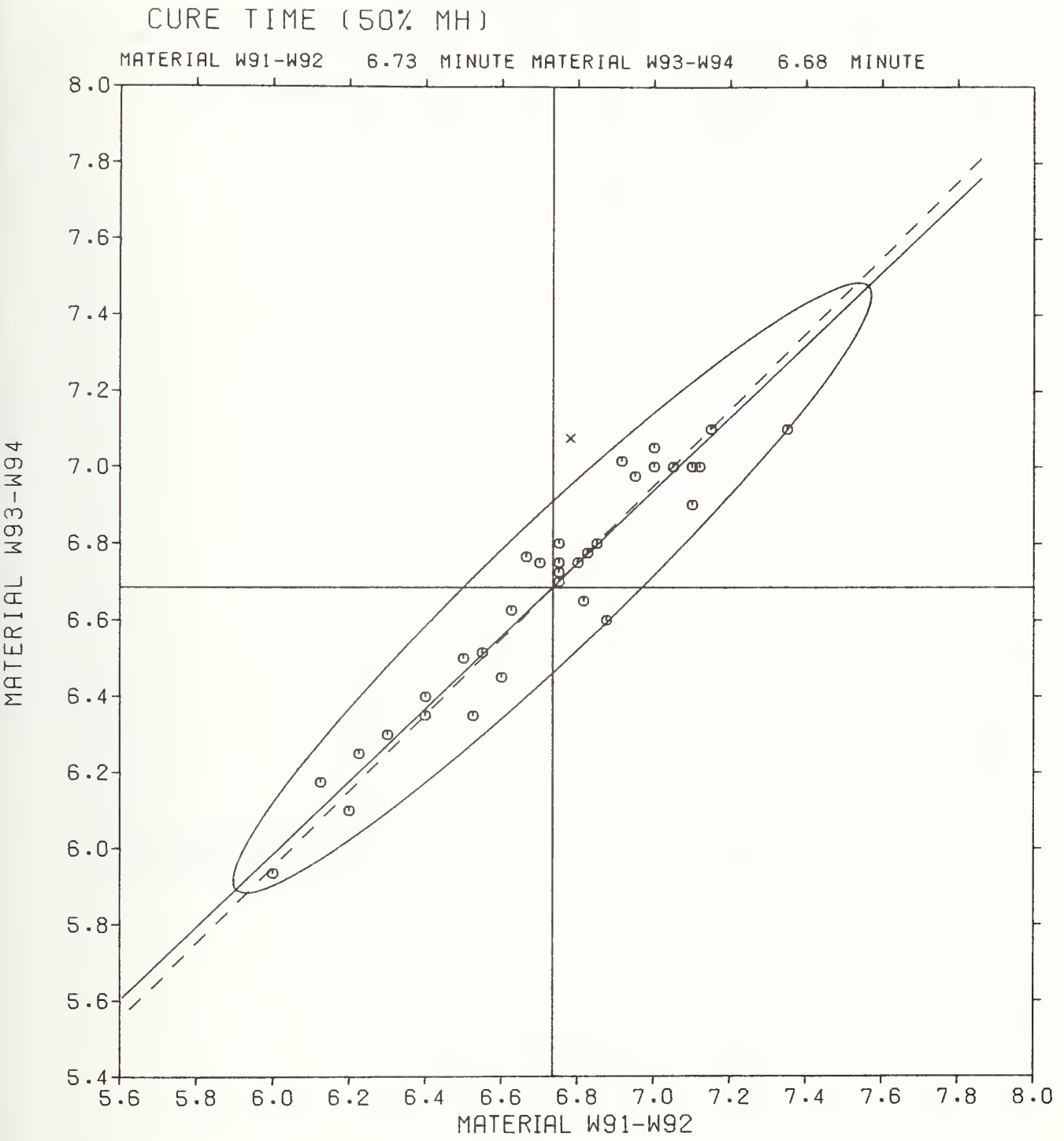
REPORT 39 - 5 SCORCH TIME - MINUTES MARCH 1979

LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL W93-W94 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		4.000	-13.7	1.93	4.000	-13.8	1.75	01	
V0064		4.725	2.0	.76	4.770	2.9	.67	70	DATA RECEIVED LATE
V0071		4.615	-.4	1.83	4.625	-.4	.90	01	
V0074	X	3.750	-19.1	1.94	3.975	-14.4	1.60	01	
V0077		4.500	-2.9	8.28X	4.400	-5.2	2.52X	01	
V0078		4.250	-8.3	.00	4.225	-9.0	.00	01	
V0079		4.512	-2.6	.75	4.500	-3.1	.00	01	
V0083		4.750	2.5	1.13	4.800	3.4	1.15	01	
V0085		4.650	.4	.00	4.550	-2.0	.00	01	
V0086		4.800	3.6	.38	4.800	3.4	.00	01	
V0090		4.750	2.5	1.84	4.925	6.1	.58	01	
V0092		4.300	-7.2	.76	4.300	-7.4	1.05	01	
V0095		4.550	-1.8	1.02	4.650	.2	.58	01	
V0100	X	4.800	3.6	1.64	4.400	-5.2	3.23X	01	
V0117		4.800	3.6	1.37	4.850	4.5	1.15	01	
V0120		4.750	2.5	1.50	4.870	4.9	.93	01	
V0128		4.800	3.6	.00	4.800	3.4	.00	01	
V0144		4.710	1.7	.19	4.565	-1.7	.40	01	
V0146	*	5.250	13.3	1.88	5.200	12.0	3.15X	01	
V0149		4.750	2.5	.38	4.775	2.9	.58	01	
V0150	X	5.850	26.3	1.77	5.800	24.9	2.51X	01	
V0152		4.800	3.6	.38	4.850	4.5	1.15	01	
V0154	X	7.660	65.3	.46	7.490	61.3	.81	01	
V0156		4.850	4.7	.84	4.875	5.0	1.00	01	
V0158		4.625	-.2	.94	4.500	-3.1	.29	01	
V0161		4.500	-2.9	.75	4.500	-3.1	.58	01	
V0166		4.850	4.7	.75	4.850	4.5	2.57X	01	
V0169		4.300	-7.2	1.13	4.350	-6.3	.58	01	
V0171	X	1.950	-57.9	.38	1.950	-58.0	.79	01	
V0182		4.200	-9.4	1.62	4.150	-10.6	.79	01	
V0190		4.125	-11.0	1.00	4.075	-12.2	.50	01	
V0207		4.600	-.7	1.37	4.550	-2.0	1.57	01	
V0208		4.450	-4.0	1.00	4.505	-3.0	1.61	01	
V0211		4.600	-.7	.38	4.700	1.2	1.15	01	
V0213		4.750	2.5	.00	4.750	2.3	.00	01	
V0214		5.200	12.2	.00	5.250	13.1	2.10	01	
V0217		4.700	1.4	.00	4.750	2.3	.00	01	
V0218		4.700	1.4	.75	4.700	1.2	1.15	01	
V0221		4.500	-2.9	.38	4.500	-3.1	2.30X	01	
V0238		4.935	6.5	1.43	4.935	6.3	1.90	01	
V0243		4.750	2.5	.38	4.850	4.5	.58	01	
		4.633	* GR. MEAN *		4.642				3 TEST DETERMINATIONS
		.267	* SD MEANS *		.286				35 LABORATORIES IN GRAND MEANS
		.077	* AVER SDR *		.050				41 LABORATORIES REPORTING
		MINUTE	* UNIT *		MINUTE				

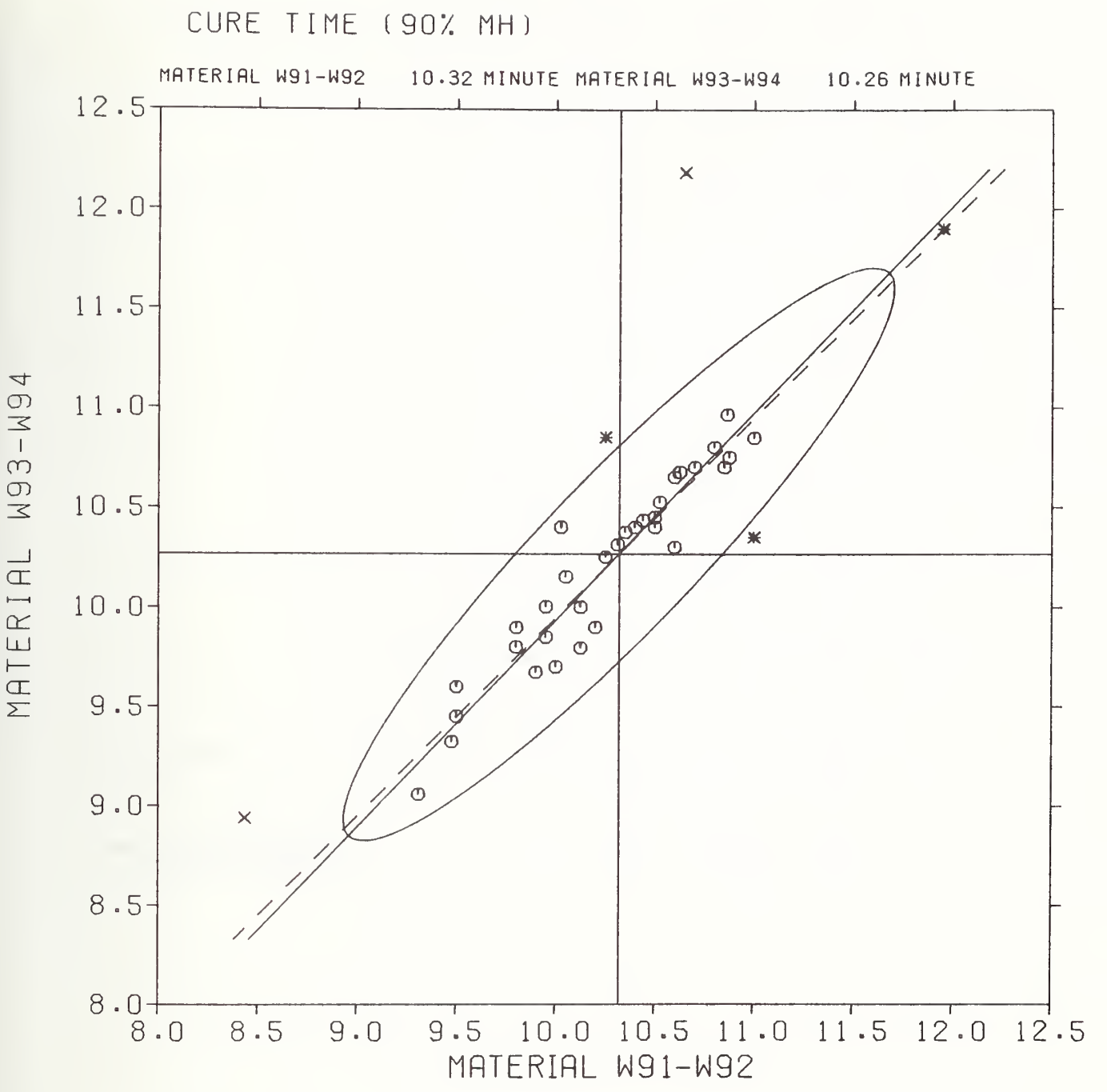

SCORCH TIME
MATERIAL W91-W92 4.633 MINUTE MATERIAL W93-W94 4.642 MINUTE
MATERIAL W93-W94
MATERIAL W91-W92
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.6 3.8 4.0 4.2 4.4 4.6 4.8 5.0 5.2 5.4 5.6 5.8

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER
CURE TIME (50% MH) - MINUTES

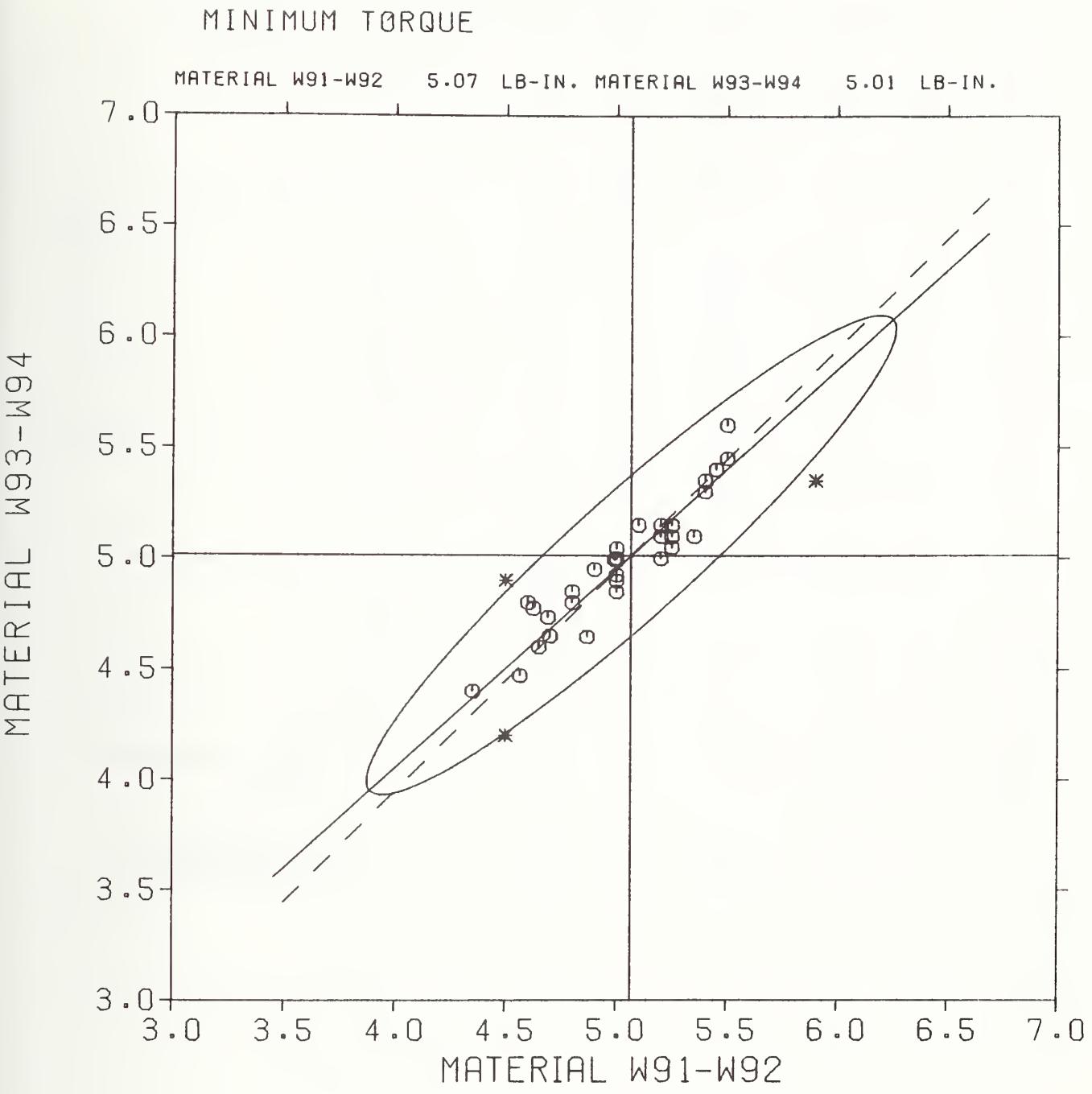
LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL W93-W94 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		6.00	-10.9	2.27	5.93	-11.2	1.45	01	
V0064		7.18	6.7	.52	7.18	7.5	1.06	*70	DATA RECEIVED LATE
V0071		6.75	.2	1.00	6.72	.6	.65	01	
V0074	X	5.44	-19.2	1.80	5.71	-14.5	3.73X	01	
V0077		6.40	-4.9	5.97X	6.35	-5.0	.92	01	
V0078		6.12	-9.0	.40	6.17	-7.6	.00	01	
V0079		6.62	-1.6	.50	6.62	-.9	.00	01	
V0083		7.05	4.7	1.39	7.00	4.7	2.02	01	
V0085		6.87	2.1	.00	6.60	-1.3	2.77X	01	
V0086		7.15	6.2	.80	7.10	6.2	.00	01	
V0090		6.91	2.7	1.77	7.01	4.9	.63	01	
V0092		6.22	-7.5	.62	6.25	-6.5	.40	01	
V0095		7.10	5.4	1.20	7.00	4.7	1.67	01	
V0100		6.70	-.5	1.09	6.75	1.0	1.60	01	
V0117		6.80	1.0	.00	6.75	1.0	1.26	01	
V0120	X	6.78	.7	2.21	7.07	5.8	.68	01	
V0128		6.85	1.7	.00	6.80	1.7	.46	01	
V0144		6.81	1.2	.32	6.65	-.5	.38	01	
V0146		7.35	9.2	1.46	7.10	6.2	2.99X	01	
V0149		6.82	1.4	.75	6.77	1.4	.84	01	
V0150	X	8.05	19.6	.80	8.00	19.7	1.26	01	
V0152		7.00	4.0	.40	7.00	4.7	.92	01	
V0154	X	11.43	69.8	.49	11.10	66.1	.82	01	
V0156		6.95	3.2	1.04	6.97	4.3	.69	01	
V0158		6.52	-3.1	1.12	6.35	-5.0	.69	01	
V0161		6.30	-6.4	.80	6.30	-5.8	1.26	01	
V0166		7.00	4.0	.80	7.05	5.5	.92	01	
V0169		6.40	-4.9	.80	6.40	-4.3	.00	01	
V0171	X	2.67	-60.3	.55	2.70	-59.6	.84	01	
V0182		6.20	-7.9	2.31	6.10	-8.7	.63	01	
V0190		6.55	-2.7	.93	6.51	-2.5	.40	01	
V0207		6.60	-2.0	.40	6.45	-3.5	2.15	01	
V0208		6.66	-1.0	.78	6.76	1.2	.51	01	
V0211		6.85	1.7	.80	6.80	1.7	.46	01	
V0213		7.10	5.4	1.72	7.00	4.7	.92	01	
V0214		7.10	5.4	2.77X	6.90	3.2	3.24X	01	
V0217		6.75	.2	.00	6.70	.2	.00	01	
V0218		6.75	.2	1.09	6.75	1.0	.00	01	
V0221		6.50	-3.5	.80	6.50	-2.8	1.39	01	
V0238		7.12	5.7	.87	7.00	4.7	1.85	01	
V0243		6.75	.2	.80	6.80	1.7	.92	01	
		6.73	* GR. MEAN *		6.68				3 TEST DETERMINATIONS
		.32	* SD MEANS *		.31				35 LABORATORIES IN GRAND MEANS
		.07	* AVER SDR *		.06				41 LABORATORIES REPORTING
		MINUTE	* UNIT *		MINUTE				


CURE TIME (50% MH)
MATERIAL W91-W92 6.73 MINUTE MATERIAL W93-W94 6.68 MINUTE
MATERIAL W93-W94
MATERIAL W91-W92
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0

LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL W93-W94 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		9.31	-9.8	2.56X	9.06	-11.7	1.94	01	
V0064		9.50	-7.9	.32	9.50	-7.4	1.12	*70	DATA RECEIVED LATE
V0071		10.44	1.2	.40	10.43	1.7	.98	01	
V0074	X	8.43	-18.2	1.86	8.94	-12.9	1.81	01	
V0077		10.20	-1.1	6.13X	9.90	-3.5	1.00	01	
V0078		9.50	-7.9	.94	9.60	-6.5	1.66	01	
V0079		10.31	-.0	.00	10.31	.5	.00	01	
V0083		11.00	6.6	1.44	10.85	5.7	1.53	01	
V0085		10.12	-1.9	.00	10.00	-2.6	2.00	01	
V0086		10.80	4.7	.27	10.80	5.2	.00	01	
V0090		10.86	5.3	.90	10.96	6.8	1.30	01	
V0092		9.50	-7.9	.73	9.45	-7.9	.83	01	
V0095	*	10.25	-.7	.81	10.85	5.7	1.00	01	
V0100		9.80	-5.0	1.18	9.80	-4.5	1.76	01	
V0117		10.60	2.7	1.00	10.30	.4	1.55	01	
V0120	X	10.65	3.2	2.49X	12.18	18.7	3.15X	01	
V0128		10.40	.8	.00	10.40	1.3	.33	01	
V0144		10.12	-1.9	.89	9.79	-4.6	.30	01	
V0146		10.85	5.2	1.74	10.70	4.2	2.40X	01	
V0149		10.35	.3	1.69	10.37	1.1	.45	01	
V0150	X	13.30	28.9	1.34	12.90	25.7	1.15	01	
V0152		10.70	3.7	.00	10.70	4.2	.33	01	
V0154	X	18.06	75.0	.25	17.49	70.4	.37	01	
V0156		10.62	3.0	2.07	10.67	4.0	.95	01	
V0158		9.90	-4.0	.32	9.67	-5.7	1.00	01	
V0161		9.95	-3.6	.73	9.85	-4.0	.67	01	
V0166		10.50	1.8	1.00	10.45	1.8	1.00	01	
V0169		9.80	-5.0	1.47	9.90	-3.5	1.45	01	
V0171	X	3.97	-61.5	.50	3.95	-61.5	.57	01	
V0182		9.47	-8.2	.94	9.32	-9.1	.33	01	
V0190		10.52	2.0	.94	10.52	2.5	.17	01	
V0207		10.05	-2.6	.73	10.15	-1.1	1.33	01	
V0208		10.02	-2.8	3.69X	10.40	1.3	3.69X	01	
V0211		10.60	2.7	.73	10.65	3.8	.67	01	
V0213	*	11.00	6.6	2.13	10.35	.8	.67	01	
V0214	*	11.95	15.8	.54	11.90	15.9	.67	01	
V0217		9.95	-3.6	.00	10.00	-2.6	.00	01	
V0218		10.50	1.8	.27	10.40	1.3	.33	01	
V0221		10.00	-3.1	1.61	9.70	-5.5	1.21	01	
V0238		10.87	5.4	4.16X	10.75	4.7	1.44	01	
V0243		10.25	-.7	.54	10.25	-.1	1.15	01	
		10.32	* GR. MEAN *		10.26				3 TEST DETERMINATIONS
		.53	* SD MEANS *		.55				35 LABORATORIES IN GRAND MEANS
		.11	* AVER SDR *		.09				41 LABORATORIES REPORTING
		MINUTE	* UNIT *		MINUTE				


CURE TIME (90% MH)
MATERIAL W91-W92 10.32 MINUTE MATERIAL W93-W94 10.26 MINUTE
MATERIAL W93-W94
MATERIAL W91-W92
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5

LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	MATERIAL W93-W94 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		5.45	.6158	7.6	.38	5.40	.6101	7.7	.42	01	
V0064		5.52	.6243	9.0	.52	5.50	.6214	9.7	.42	*70	DATA RECEIVED LATE
V0071	*	5.90	.6666	16.4	3.34X	5.35	.6045	6.7	1.16	01	
V0074		4.62	.5226	-8.7	1.82	4.77	.5395	-4.8	1.82	01	
V0077	X	7.25	.8192	43.1	3.04X	6.95	.7853	38.6	1.16	01	
V0078		5.10	.5762	.6	.00	5.15	.5819	2.7	.00	01	
V0079		5.00	.5649	-1.3	.00	5.00	.5647	-.3	.00	01	
V0083		5.20	.5875	2.6	1.38	5.10	.5762	1.7	.73	01	
V0085		4.69	.5300	-7.4	.00	4.74	.5350	-5.5	.00	40	ORIGINAL IN NEWTON-METER
V0086		4.70	.5311	-7.2	.00	4.65	.5254	-7.2	.42	01	
V0090		4.80	.5424	-5.3	1.57	4.85	.5480	-3.3	1.48	01	
V0092		5.40	.6101	6.6	1.14	5.35	.6045	6.7	.00	01	
V0095		5.20	.5875	2.6	.76	5.15	.5819	2.7	.00	01	
V0100	*	4.50	.5085	-11.2	.00	4.90	.5537	-2.3	.00	01	
V0117		4.90	.5537	-3.3	1.14	4.95	.5593	-1.3	.73	01	
V0120		4.65	.5254	-8.2	1.14	4.60	.5198	-8.2	.85	01	
V0128		5.20	.5875	2.6	.00	5.00	.5649	-.3	.00	01	
V0144	*	6.85	.7740	35.2	1.14	6.70	.7570	33.6	1.16	01	
V0146		5.50	.6214	8.5	1.76	5.60	.6327	11.7	1.58	01	
V0149		5.00	.5649	-1.3	1.40	4.92	.5565	-1.8	2.38X	01	
V0150		5.35	.6045	5.6	3.55X	5.10	.5762	1.7	1.85	01	
V0152		4.80	.5424	-5.3	.38	4.80	.5424	-4.3	.42	01	
V0154	X	8.35	.9435	64.8	.76	8.30	.9378	65.6	.42	01	
V0156		5.00	.5649	-1.3	.76	4.85	.5480	-3.3	.42	01	
V0158		4.99	.5638	-1.5	.46	4.99	.5644	-.4	.00	01	
V0161		4.35	.4915	-14.2	.38	4.40	.4972	-12.2	1.16	01	
V0166		4.70	.5311	-7.2	.76	4.65	.5254	-7.2	.42	01	
V0169		4.87	.5500	-3.9	1.80	4.65	.5250	-7.3	1.73	40	ORIGINAL IN NEWTON-METER
V0171	*	4.50	.5085	-11.2	1.14	4.20	.4746	-16.2	.85	01	
V0182		5.50	.6214	8.5	1.04	5.45	.6158	8.7	2.20X	01	
V0190	X	12.00	1.3559	99.9	2.28X	11.75	1.3276	99.9	1.53	01	
V0207		5.25	.5932	3.6	.76	5.10	.5762	1.7	.85	01	
V0208		4.56	.5158	-9.9	1.44	4.47	.5051	-10.8	.81	01	
V0211		5.40	.6101	6.6	.76	5.30	.5988	5.7	1.97X	01	
V0213		5.45	.6158	7.6	.38	5.40	.6101	7.7	.00	01	
V0214		5.25	.5932	3.6	1.00	5.15	.5819	2.7	.85	01	
V0217		4.60	.5198	-9.2	.00	4.80	.5424	-4.3	.00	01	
V0218		5.00	.5649	-1.3	.00	4.90	.5537	-2.3	.42	01	
V0221		5.00	.5650	-1.3	.34	5.04	.5700	.6	1.72	40	ORIGINAL IN NEWTON-METER
V0238		5.00	.5649	-1.3	.95	5.00	.5649	-.3	.55	01	
V0243		5.25	.5932	3.6	1.04	5.05	.5706	.7	1.58	01	
		5.07	.5726	* GR. MEAN *		5.01	.5664				3 TEST DETERMINATIONS
		.46	.0521	* SD MEANS *		.42	.0472				37 LABORATORIES IN GRAND MEANS
		.08	.0086	* AVER SDR *		.07	.0077				41 LABORATORIES REPORTING
		LB-IN.	N-M	* UNIT *		LB-IN.	N-M				


MINIMUM TORQUE
MATERIAL W91-W92 5.07 LB-IN. MATERIAL W93-W94 5.01 LB-IN.
MATERIAL W93-W94
MATERIAL W91-W92
7.0
6.5
6.0
5.5
5.0
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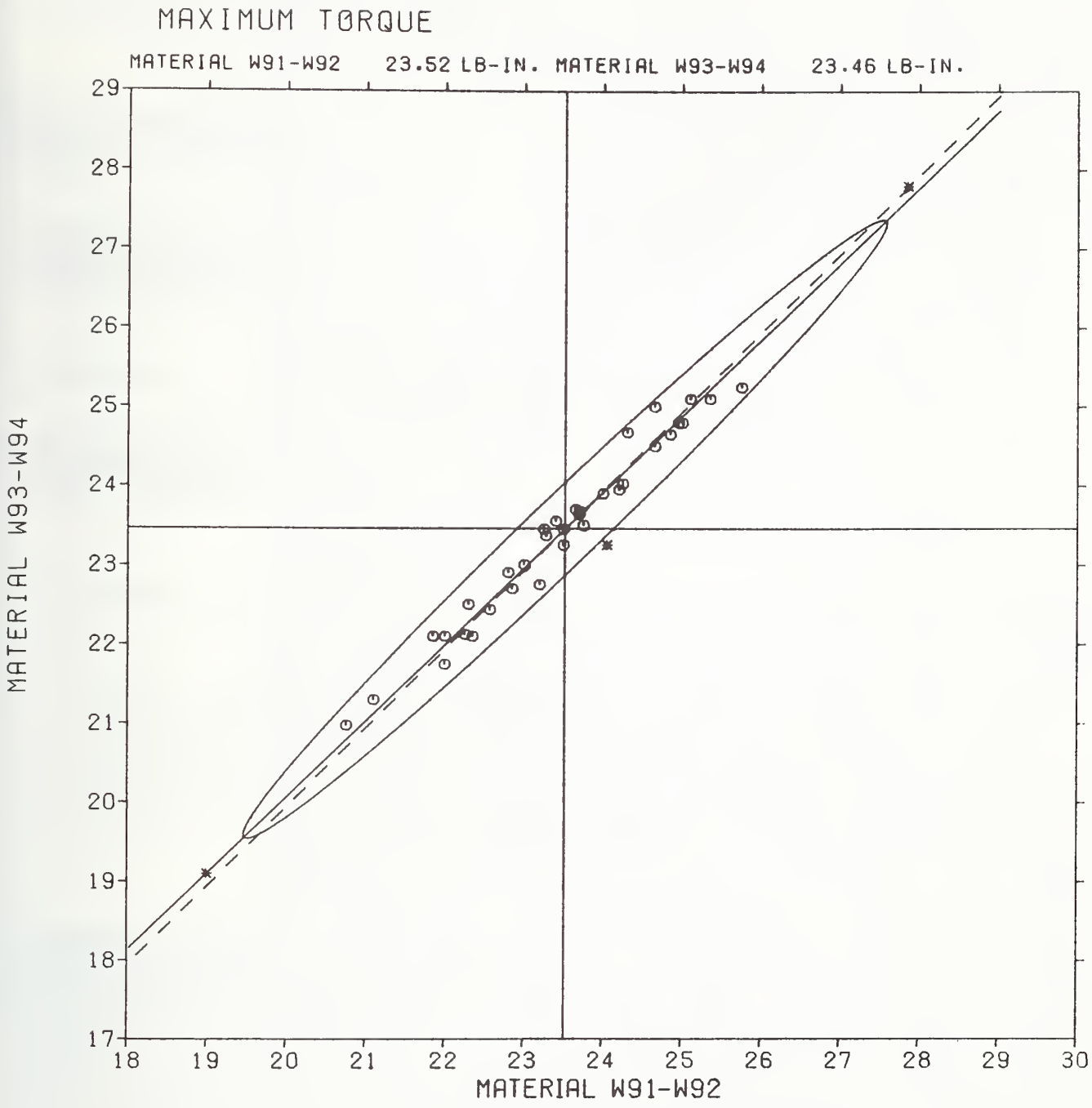
INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER
MAXIMUM TORQUE - POUND-INCHES

LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	MATERIAL W93-W94 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		25.10	2.8360	6.7	1.51	25.10	2.8360	7.0	.00	01	
V0064		23.55	2.6609	.1	.53	23.50	2.6553	.2	.53	70	DATA RECEIVED LATE
V0071	*	24.05	2.7174	2.2	4.72X	23.25	2.6270	-.9	1.98	01	
V0074		23.40	2.6440	-.5	.35	23.55	2.6609	.4	1.42	01	
V0077		25.75	2.9095	9.5	1.06	25.25	2.8530	7.6	1.07	01	
V0078		25.10	2.8360	6.7	.92	25.10	2.8360	7.0	.71	01	
V0079		23.70	2.6779	.8	.92	23.67	2.6750	.9	.00	01	
V0083		24.20	2.7344	2.9	1.84	23.95	2.7061	2.1	2.01	01	
V0085		20.75	2.3451	-11.8	.61	20.98	2.3701	-10.6	.00	40	ORIGINAL IN NEWTON-METER
V0086		22.85	2.5818	-2.9	.69	22.70	2.5649	-3.2	.71	01	
V0090		24.25	2.7400	3.1	1.15	24.02	2.7146	2.4	.49	01	
V0092		25.35	2.8643	7.8	1.32	25.10	2.8360	7.0	.94	01	
V0095		23.25	2.6270	-1.2	.46	23.45	2.6496	-.0	.71	01	
V0100		22.30	2.5197	-5.2	.00	22.50	2.5423	-4.1	.00	01	
V0117		22.00	2.4858	-6.5	.63	22.10	2.4971	-5.8	.36	01	
V0120		22.80	2.5762	-3.1	.69	22.90	2.5875	-2.4	.97	01	
V0128		23.75	2.6835	1.0	1.44	23.50	2.6553	.2	.71	01	
V0144		24.95	2.8191	6.1	.46	24.80	2.8022	5.7	.71	01	
V0146		23.50	2.6553	-.1	2.90X	23.45	2.6496	-.0	1.64	01	
V0149		22.25	2.5140	-5.4	.58	22.12	2.4999	-5.7	1.24	01	
V0150		23.50	2.6553	-.1	.00	23.25	2.6270	-.9	1.78	01	
V0152		23.00	2.5988	-2.2	.00	23.00	2.5988	-1.9	.36	01	
V0154	*	27.85	3.1468	18.4	.69	27.80	3.1411	18.5	.97	01	
V0156		23.20	2.6214	-1.4	1.91	22.75	2.5705	-3.0	.71	01	
V0158		24.00	2.7118	2.0	1.38	23.90	2.7005	1.9	.67	01	
V0161		21.10	2.3841	-10.3	1.01	21.30	2.4067	-9.2	1.07	01	
V0166		22.35	2.5253	-5.0	1.29	22.10	2.4971	-5.8	.00	01	
V0169		22.57	2.5501	-4.0	2.47X	22.44	2.5351	-4.3	.94	40	ORIGINAL IN NEWTON-METER
V0171	*	19.00	2.1468	-19.2	.23	19.10	2.1581	-18.6	.71	01	
V0182		24.65	2.7852	4.8	1.90	25.00	2.8248	6.6	1.33	01	
V0190	X	48.25	5.4518	99.9	.63	48.30	5.4574	99.9	.62	01	
V0207		23.65	2.6722	.5	1.01	23.70	2.6779	1.0	1.29	01	
V0208		24.30	2.7462	3.3	.83	24.67	2.7880	5.2	4.01X	01	
V0211		24.85	2.8078	5.6	1.63	24.65	2.7852	5.1	.62	01	
V0213		25.00	2.8248	6.3	.46	24.80	2.8022	5.7	3.10X	01	
V0214		24.65	2.7852	4.8	1.03	24.50	2.7683	4.5	.36	01	
V0217		21.85	2.4688	-7.1	.00	22.10	2.4971	-5.8	.00	01	
V0218	X	10.45	1.1807	-55.6	.23	10.35	1.1694	-55.9	.36	01	
V0221		23.28	2.6301	-1.0	1.44	23.37	2.6401	-.4	4.40X	40	ORIGINAL IN NEWTON-METER
V0238		22.00	2.4858	-6.5	.58	21.75	2.4575	-7.3	3.55X	01	
V0243		23.70	2.6779	.8	1.01	23.65	2.6722	.8	1.55	01	
		23.52	2.6577	* GR. MEAN *		23.46	2.6503				3 TEST DETERMINATIONS
		1.57	.1773	* SD MEANS *		1.51	.1710				38 LABORATORIES IN GRAND MEANS
		.13	.0142	* AVER SDR *		.08	.0092				41 LABORATORIES REPORTING
		LB-IN.	N-M	* UNIT *		LB-IN.	N-M				


MAXIMUM TORQUE
MATERIAL W91-W92 23.52 LB-IN. MATERIAL W93-W94 23.46 LB-IN.
MATERIAL W93-W94
MATERIAL W91-W92
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15. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Collaborative Reference Programs provide participating laboratories with the means for checking periodically the level and uniformity of their testing in comparison with that of other participating laboratories. An important by-product of the programs is the provision of realistic pictures of the state of the testing art. This is one of the periodic reports showing averages for each participant, within and between laboratory variability, and other information for participants and standards committees.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Collaborative reference program; Laboratory evaluation; Precision; Reference samples; Rubber; Testing calibration.

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